SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the requirements and procedures for mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results. Work is limited to all new and revised systems effected by this contract.

1.2 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes the balance of air and water distribution, adjustment of total system to provide design quantities, electrical measurement, and verification of performance of all equipment and automatic controls.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

1.3 SUBMITTALS

A. Agency Data:
1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

C. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC or NEBB are proposed.

D. Certified Reports: Submit testing, adjusting, and balancing reports bearing the signature of the Test and Balance Engineer or technician. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
   a. General Information and Summary
   b. Air Systems
   c. Hydronic Systems
   d. Special Systems
4. Report Contents: Provide the following minimum information, forms and data:
   a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the name address, telephone number, and signature of the Test and Balance Engineer or technician. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
   b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system.

E. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.4 QUALITY ASSURANCE

A. Agency Qualifications: Employ the services of an either AABC or NEBB certified independent testing, adjusting, and balancing agency to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Acceptable Agencies: Subject to compliance with requirements, the following agencies are aproved to bid:
1. KCO Inc.(406) 222-0018; Livingston, MT
2. Big Horn Corp., Barry Robinson (406) 248-5299; Billings, MT
3. Mechanical Technology, Rich and Rod Rose (406) 245-8340; Billings, MT
4. Rocking D&R Ranch, Inc., Doug Mullins, (406) 538-2839 ; Lewistown, MT

C. Codes and Standards:
1. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

D. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer, representatives of installers of the mechanical systems, and owner's representative. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing. Give minimum 5 days notice to all parties of scheduled conference.

1.5 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures. All structural and architectural aspects of the building which may effect balancing must be complete.

1.6 SEQUENCING AND SCHEDULING

A. Test, adjust, and balance the air systems before hydronic systems.

B. Coordinate with mechanical contractor ensure sufficient number of trips are scheduled to accommodate all phase of construction.

PART 2 – PRODUCTS – Not Used.

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:
1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Adjust supply diffusers for proper throw.
11. Lubricate all motors and bearings.
12. Check fan belt tension.
13. Check fan rotation.
14. Correct system deficiencies prior to balancing. Coordinate with mechanical and electrical contractor.

3.2 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

A. Before operating the system perform these steps:
1. Open valves to full open position. Close coil bypass valves.
2. Remove and clean all strainers.
3. Examine hydronic systems and determine if water has been treated and cleaned.
4. Check pump rotation.
5. Clean and set automatic fill valves for required system pressure.
6. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
7. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
8. Set temperature controls so all coils are calling for full flow.
9. Check operation of automatic bypass valves.
10. Check and set operating temperatures of chillers to design requirements.
11. Lubricate all motors and bearings.
12. Correct system deficiencies prior to balancing. Coordinate with mechanical and electrical contractor.

3.3 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

J. Perform capacity tests on AHU's in both of 100% outside air and min. outside air test conditions. Pitot Tube Traverses shall record total supply and return air flow for each test condition. Amps and line voltage shall be measured and recorded for each test condition as well.

K. Perform capacity test on VAV’s in both 100% airflow and minimum airflow conditions.

3.4 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Notify the engineer and project manager after initial field data is collected on any system which deviates from expected performance of the design.

H. Schedule one additional trip for purposes of testing, adjusting, and balancing systems subsequent to significant system modifications. Resubmit test results.

3.5 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

END OF SECTION 15990